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Eing.: 24. APR. 2003		
PA. Dr. Peter Riebling		
Bearb.	Vorgeseht.	

PATENT SPECIFICATION

Application Date: April 28, 1926. No. 11,163 / 26.

Complete Left: Feb. 28, 1927.

Complete Accepted: July 28, 1927.

274.954



PROVISIONAL SPECIFICATION.

Improved Means for Fixing Pins, Spindle Ends, and the like in Metal and other Articles.

We, CURT GEORGE LANGE, of 33B, Sisters Avenue, Battersea, London, S.W. 11, of Swedish nationality, and LEO KELSEY, of 26, Campden Hill Gardens, London, W. 8, of British nationality, do hereby declare the nature of this invention to be as follows:—

This invention has for its object to provide improved means for fixing pins, spindle ends and the like in metal and other articles.

According to the present invention the end of the pin, spindle, or the like, is made a tight fit in the hole in the article to which it is to be attached and the end of the pin or spindle is recessed with a longitudinal hole into which is forced a ball of steel or other metal of slightly larger diameter than the hole.

The surface of the pin or spindle which is received in the hole in the article is preferably knurled or roughened to ensure a better grip when this part is expanded by forcing the ball into the recess.

As an alternative a circular group of holes with corresponding balls may be employed.

The invention is particularly applicable for fixing small gear wheels, operating knobs or discs upon the ends of spindles or rods.

As an example—in fixing a small brass pinion to a spindle, the end of which we will assume to be reduced by a shoulder to $\frac{1}{16}$ " in diameter, the reduced end of the spindle, is formed with a knurled surface and is recessed at its end with an axial hole $\frac{3}{16}$ " in diameter and of greater depth than the diameter of the ball to be inserted therein.

The said end of the spindle is made a tight fit in the hole in the pinion and after its insertion therein a $\frac{1}{16}$ " steel ball is forced into the end recess with the result that the end of the spindle is expanded and rigidly fixed to the pinion.

The steel ball retains its position by the re-expansion of the metal in the outer part of the recess.

In another example the end of a circular or tubular member may be formed with a circular group of holes arranged near its periphery so that when the balls are inserted in the said holes the circumference of the circular tubular member will be suitably expanded.

Dated this 28th day of April, 1926.

ARTHUR E. EDWARDS,
Chartered Patent Agent,
Chancery Lane Station Chambers,
London,
Agent for the Applicants.

COMPLETE SPECIFICATION.

Improved Means for Fixing Pins, Spindle Ends, and the like in Metal and other Articles.

We, CURT GEORGE LANGE, of 33B, Sisters Avenue, Battersea, London, S.W. 11, of Swedish nationality, and LEO KELSEY, of 26, Campden Hill Gardens, London, W. 8, of British nationality, do hereby declare the nature of this invention and in what manner the same is to be performed, to be

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particularly described and ascertained in and by the following statement:—

This invention has for its object to provide improved means for fixing pins, spindle ends and the like in metal and other articles, and for generally fixing articles together.

The improved means are of the type wherein a hollow member or pin made a tight fit in a hole is secured therein by expansion due to a plug like member being forced into the hollow.

According to the present invention a pin, spindle, or member is adapted to be inserted in a hole in the article to which it is to be attached, and the pin or spindle is recessed with a longitudinal hole or holes into which or each of which is forced a ball or equivalent part-spherical ended plug of steel or other metal of slightly larger diameter than the hole, the said ball or plug remaining in position to support the expanded or deformed surface.

The surface of the pin or spindle which is received in the hole in the article may be knurled or roughened to ensure a better grip when this part is expanded by forcing the ball into the recess.

And as an alternative a group of holes with corresponding balls may be employed.

The invention is particularly applicable for fixing small gear wheels, operating knobs or discs upon spindles or rods.

The accompanying drawings show several ways of carrying out the invention—

Fig. 1 is a sectional elevation showing one form of the invention.

Fig. 2 is an end view, and

Fig. 3 a sectional elevation showing a modified construction.

Figs. 4 to 13 show several other ways of employing the invention.

Figs. 4, 5, 6 and 7 are sectional views showing four modified arrangements.

Figs. 8, 9, 10, 11, 12 and 13 show in face view and side view respectively three other arrangements.

Fig. 14 shows in sectional view two parts with the ball inserted before the parts are forced together.

Fig. 15 is a sectional view showing the parts of Fig. 14 assembled.

Fig. 16 is a sectional view of a further modification where the ball is inserted prior to the parts being forced together.

Similar letters refer to similar parts where possible.

In the arrangement shown in Fig. 1, *a* is the end of a spindle which is made a fit in the hole in the pinion or other article *b* to which it is to be attached, *c* is a longitudinal hole or recess in the end of

the spindle into which is forced a ball *d* of steel or other metal of slightly larger dimensions than the hole.

The surface of the pin or spindle where it is recessed in the hole in the pinion may be ribbed as indicated at *e* or knurled or roughened in some other suitable manner to ensure a better grip.

Now when the steel ball *d* is forced into the end recess or hole *c*, the end of the spindle *a* is expanded with the result that the said spindle is rigidly fixed to the pinion *b*.

The steel ball *e* may retain its position by the re-expansion of the metal forming a contraction of the outer part of the recess or hole *c*.

A similar result may be obtained with the arrangement shown in Figs. 2 and 3, wherein a spindle *a*, assumed to be of larger dimensions than that shown in Fig. 1, is formed with a group of holes *c* arranged near its periphery so that when the balls *d* are forced into the said holes *c* the circumference *e* of the spindle end will be suitably expanded and firmly fixed in position to the article *b*.

The end of the spindle may be of tubular form if desired, the group of holes *c* being arranged in the annular thickness of the material.

In the modified arrangements shown in Figs. 4 and 5, a plug *d*¹ with a part spherical head marked *d*², *d*³ respectively is substituted for the ball *d*.

In the form shown in Fig. 4, the part spherical head *d*² is connected to the other part of the plug *d* by a neck of reduced diameter forming a groove into which the deformed metal of the spindle may re-expand and form a retaining contraction.

In the form shown in Fig. 5, the plug *d*¹ is formed with a rounded or semi-spherical end *d*³.

The invention provides a simple and effective means for fixing small spindles to various articles and the arrangement shown in Figs. 2 and 3 is applicable to spindles of larger diameter.

In carrying out the present invention any two or more parts which are to be joined together or to some third part need not necessarily be a tight or force fit with each other or to the third part, the said parts may fit easily upon each other before either or both are expanded by means of a ball or part spherical expanding member.

The ball or suitably shaped pin need not necessarily touch or abut against the bottom of the hole. Figs. 6 and 7 show the ball *d* so placed.

Further the ball or pin may if neces-

sary project outside the hole into which it has been forced, see for example the ball *d* shown in Fig. 6.

5 The ball may be retained by the displaced material re-expanding so as to form a contraction behind same, or as indicated in Fig. 7, by reason of the friction between the surface of the ball *d* and the hole *c* into which it has been
10 forced.

As a general principle the amount of expansion of the part into which a ball or pin has been forced is governed by the following:—

15 1. The amount by which the hole is smaller than the pin or ball to be inserted.

2. The position of the ball or pin in relation to the contour and periphery of the part to be expanded.

20 3. The relative dimensions of the male and female portions on the parts to be fixed to each other.

4. The material of which the parts are made.

25 5. The rigidity and stiffness of the parts to be fixed, i.e. a slender or non-rigid female part would not resist the expansion of a rigid male part, and the opposite would also hold good.

30 By suitably spacing or proportioning the balls or pins, parts which have unsymmetrical contours on their mating portions may be fixed together as indicated in Figs. 8 and 9.

35 If desired one ball or pin may be used to force outward several balls or pins and so expand one part into another, by suitably grouping the balls or pins in such a manner that the introduction, into the centre of the group, of another ball or
40 pin, will cause the former to move outward, and so expand the part into which they have been placed.

One such arrangement is shown in Figs. 10 and 11, where several balls *d*
45 assembled in a recess *c* in a member *a* have been forced outwardly by the introduction of a central ball *f*, which in the arrangement shown is forced into position by a projection *g* on the inner face
50 of a disc or member *h* screwed into position.

With the last mentioned arrangements the expanding force which is holding two
55 or more parts together may be dissipated by removing the central ball *f*, and so, by the collapsing of the previously expanded part, release the part or parts which were fixed together.

60 As shown in Figs. 12 and 13, the part which is to be expanded may be suitably split or relieved in such manner, as by slits *i*, that expansion is facilitated.

The method of assembling parts according to the present invention, may be

modified to suit particular requirements, that is to say.—The parts may be first attached or placed together and the ball or pin inserted, or the ball may be inserted and the parts forced together, if they are of such a nature that such a procedure is practicable.

One such arrangement is shown in Figs. 14 and 15, where the parts *a* and *b* shown separated in Fig. 14 are forced
75 together with the inserted ball *d* as in Fig. 15.

Again, the parts to be joined may be assembled and forced together at the same time as the ball *d* is inserted. Fig. 16 shows such an arrangement wherein the ball *d* is forced into the hole *c* as and when the members *a* and *b* are forced together.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. The improved means for fixing articles or members together, for example for fixing pins, spindle ends or the like in metal and other articles or members, wherein the pin, spindle or member is made a fit in a hole in the article to which it is to be attached, and the pin, spindle or member is recessed with a longitudinal hole or holes into which or each of which is forced a ball of steel or other metal of slightly larger diameter than the hole, the said ball remaining in position to support the expanded or deformed surface.

2. A modification of the invention according to Claim 1, wherein the surface of the pin, spindle or the like which is received in the hole is knurled or roughened substantially as and for the purpose set forth.

3. A modification of the invention according to Claim 1, or 2, wherein a circular group of holes with corresponding balls are employed.

4. A modification of the invention according to any of the preceding claims, wherein a plug with part spherical head or end is employed in place of the ball, substantially as set forth.

5. A modification of the invention claimed in any of the preceding claims wherein the ball or part spherical ended plug does not touch or abut against the bottom of the hole into which it is forced.

6. A modification of the invention claimed in any of the preceding claims, wherein the ball or part spherical ended plug projects outside the hole into which it is forced.

- 4
7. A modification of the invention claimed in any of the preceding claims, wherein the same is applied to mating parts which have unsymmetrical contours. 5
8. A modification of the invention claimed in any of the preceding claims, wherein a central ball or part spherical ended plug is inserted in a group of balls or part spherical plugs to force the same outwards, the said central ball or plug being in some cases removable for releasing the connected parts. 10
9. A modification of the arrangement claimed in Claim 8, wherein a device held in place by a screw is adapted to hold the central ball or plug in position. 15
10. A modification of the invention claimed in any of the preceding claims, wherein the part which is to be expanded is suitably slit or made resilient to facilitate expansion. 20
11. A modification of the invention claimed in any of the preceding claims, wherein the parts are arranged to be assembled with the ball or plug inserted in its hole before the parts are forced together. 25
12. A modification of the arrangement according to Claim 11, wherein the ball or plug is inserted in its hole and the parts to be joined are forced together simultaneously with the forcing in of the ball or plug. 30
13. The several forms of the improved means for fixing articles or members together, for example, for fixing pins, spindle ends or the like in metal articles or members substantially as herein described with reference to and as illustrated in the accompanying drawings. 35 40
- Dated this 28th day of February, 1927.
- ARTHUR E. EDWARDS,
Chartered Patent Agent,
Chancery Lane Station Chambers,
London, 45
Agent for the Applicants.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1927.

[This Drawing is a reproduction of the Original on a reduced scale.]

FIG. 1.

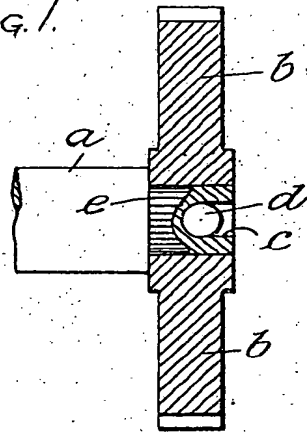


FIG. 2.

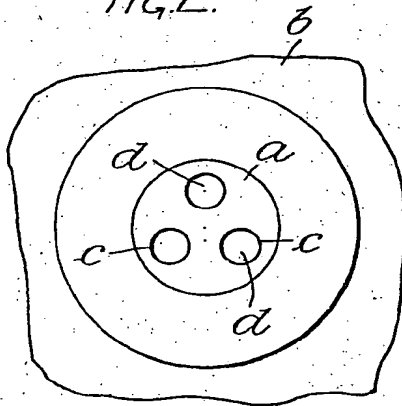


FIG. 3.

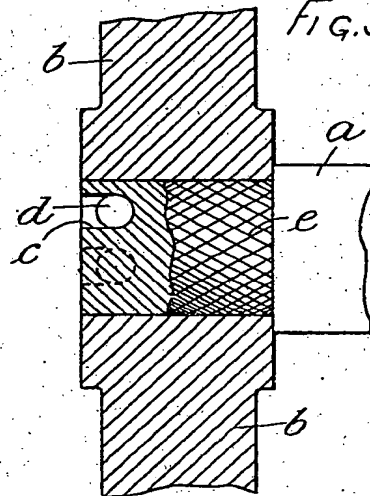


FIG. 4.

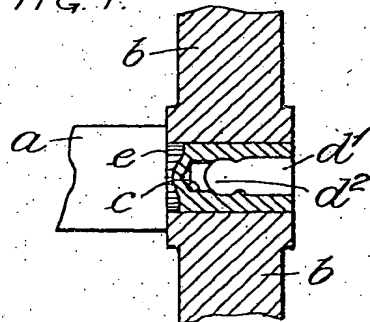


FIG. 5.

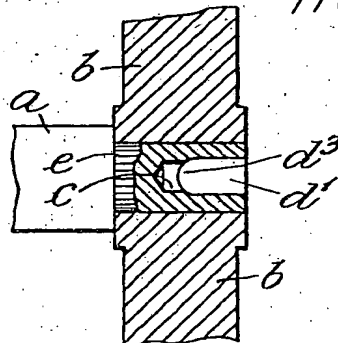


FIG.

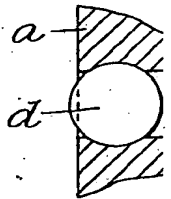


FIG. 8.

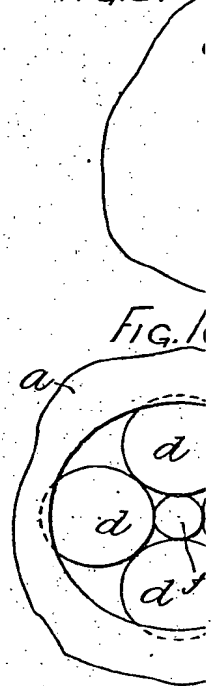


FIG.

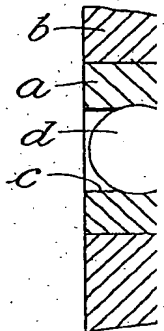


FIG. 6.

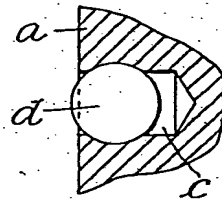


FIG. 7.

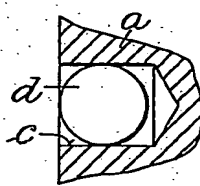


FIG. 12.

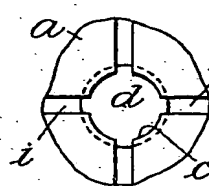


FIG. 13.

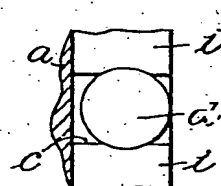


FIG. 8.

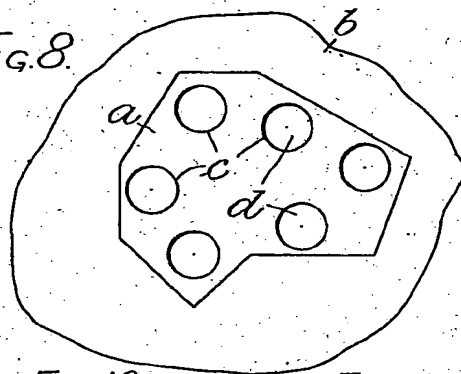


FIG. 9.

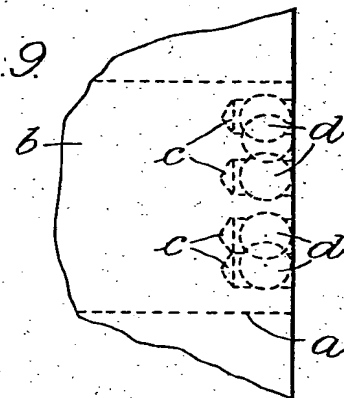


FIG. 10.

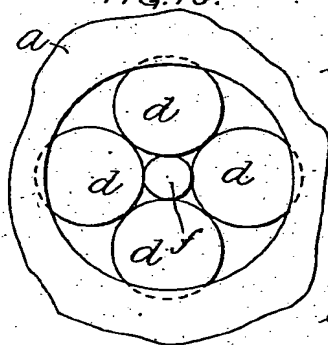


FIG. 11.

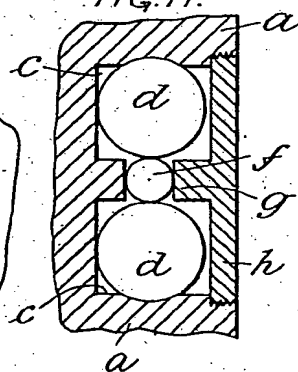


FIG. 14.

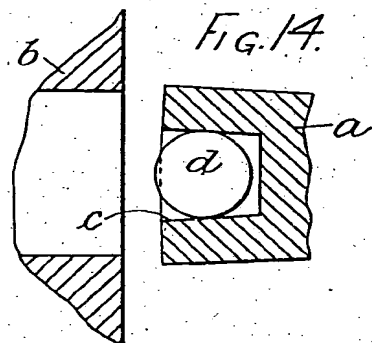


FIG. 15.

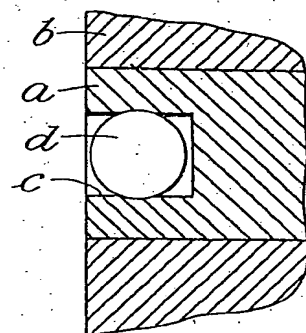
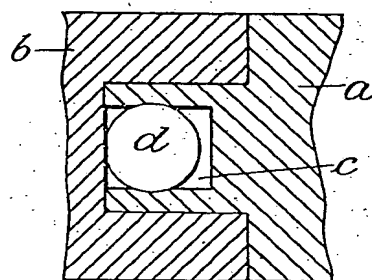
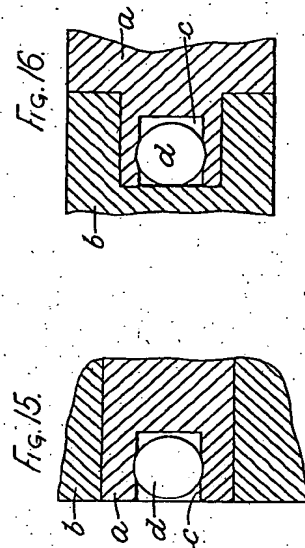
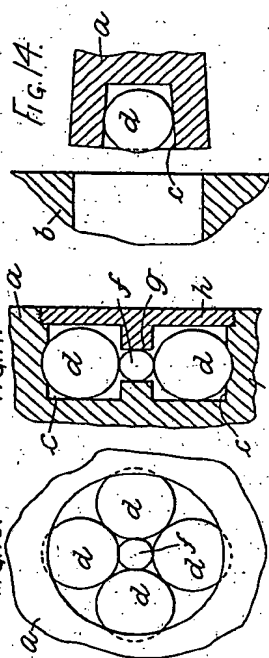
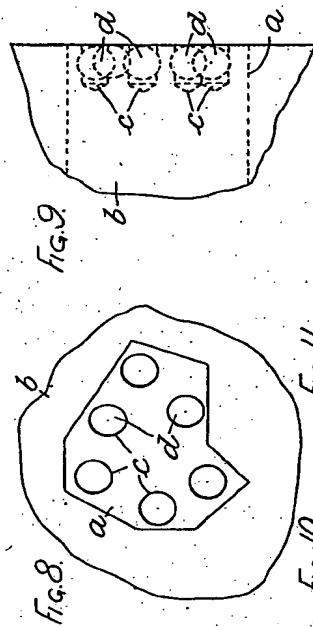
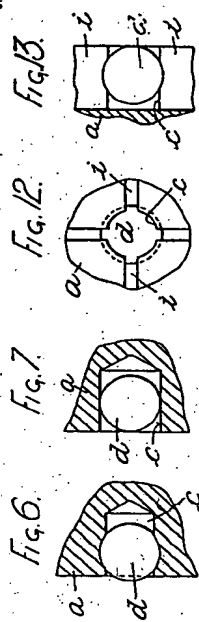
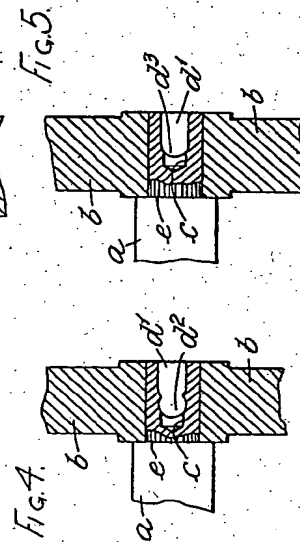
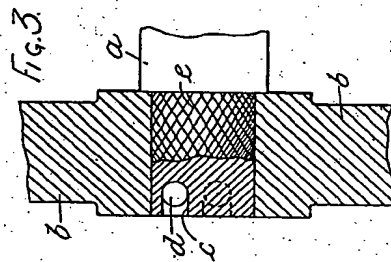
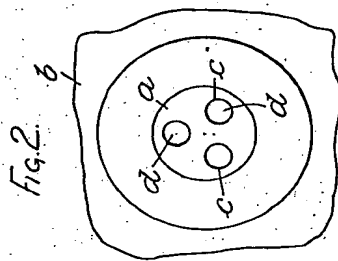
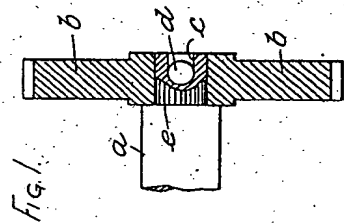


FIG. 16.





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